

HR-353 Epoxy-Coated Strands in Composite Precast Prestressed Concrete Panels

ABSTRACT

This final report for Phase 1 of the research on epoxy-coated, prestressing strands in precast prestressed concrete (PC) panels has been published in two volumes. Volumes 1--Technical Report contains the problem descriptions, literature review, and survey results; descriptions of the test specimens, experimental test, and analytical models; discussions of the analytical and experimental results; summary, conclusions, and recommendations; list of references; and acknowledgments. Volume 2—Supplemental Report contains additional information in the form of summarized responses to the questionnaires; graphs showing the strands forces; figures showing the geometry of the specimens and concrete crack patterns that formed in the strands transfer length and strands development length specimens, load-point deflections, and strand-slip measurements for the strand development length specimens.

PC subdeck panels that act compositely with a cast-in-place reinforced concrete topping slab have been used in PC girder bridges in Iowa in many years. The durability of this alternate form of bridge deck construction has been questioned because the prestressing strands and welded wire fabric (WWF) that reinforce the panels are not epoxy coated. The primary objective of the research was to determine the feasibility of using grit-impregnated, epoxy-coated strands and epoxy-coated WWF in thin PC panels. Since larger bond stresses occur between a grit-impregnated, epoxy-coated strand and the surrounding concrete when compared to uncoated strands, a minimum thickness for a PC panel needed to be established so that concrete cracking would not occur when the panels were prestressed. Other objectives of the research were to determine the transfer and development length for 3/8-in. diameter, seven-wire, 270-ksi, low-relaxation, grit-impregnated, epoxy-coated (coated) and bare (uncoated) prestressing strands.

The research program included a comprehensive literature review, surveys of design agencies and precast manufacturers to establish the use of epoxy-coated reinforcement in bridge construction, an extensive laboratory study that involved the testing of 115 PC specimens and analytical studies of strand transfer and development lengths. The survey responses showed that the use of epoxy-coated strands in bridge components has been minimal. Only one design agency has used coated strands in PC subdeck panels. The experimental testing revealed that when coated strands are located at the middepth of a PC panel, a 3-in. minimum thickness was required to prevent concrete cracking when the strands were cut, and that the measured coated-strands transfer and development lengths were about one-half of those measured length for uncoated strands. The amount of concrete side cover provided in the test specimens affected the uncoated-strands transfer and development lengths but apparently did not affect the coated-strands development length. The influence of concrete side cover on the transfer length for coated strands was inconclusive. For the multiple-strands specimens, the 6-in. strand spacing did not appear to affect the transfer or development lengths for either the coated or uncoated strands. Some of the analytical models proposed by other researchers

provided a good prediction of the strands transfer and development lengths. The AASHTO Specification expression for strand development length significantly overestimated the measured strand development length for coated strands, substantially underestimated this length for uncoated strands with small amounts of concrete side cover, and provided a good prediction for this length for uncoated strands with adequate side cover and spacing.